The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD – this document) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.

West Virginia Space Grant Consortium
Lead Institution: West Virginia University
Director: Majid Jaridi, PhD
Telephone Number: (304) 293-4099
Consortium URL: wvspacegrant.org
Grant Number: NNX10AK62H

PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The West Virginia Space Grant Consortium is a Designated Consortium funded at a level of $575,000 for fiscal year 2014.

PROGRAM GOALS

The NASA West Virginia Space Grant Consortium's (WVSGC) mission is to enhance educational programs and research in the fields of Science, Technology, Engineering and Math (STEM) in the state of West Virginia (WV). An important goal of WVSGC is to capture, channel, and enrich the activities of the current and potential scientists as well as engineers through the Consortium's affiliate member's network, with special emphasis to increase the participation of under-represented groups in our programs. Listed below is the WVSGC SMART objectives within each NASA related Outcome.

Outcome 1

Fellowship/Scholarship Programs

Goal: To contribute to, and advance NASA's vision and strategies as outlined in various NASA documents, specifically in terms of workforce development.

SMART objectives:

- To maintain the minimum number of Space Grant fellowships/scholarships at 120/yr.;
- To place at least ten summer interns at NASA field centers (including the Academies) and high-technology companies in WV; and
- To increase the number of students who benefit from our Fellowship/Scholarship and summer internship programs by 5% per year in the next five years (assuming the availability of at least the same level of funding).

Higher Education Programs

Goal: To enhance higher education capabilities in STEM in WV. WVSGC is in a unique position to initiate and support innovative programs that enable WV students to engage in hands-on experiences that will better prepare them for careers at NASA, its contractors, and other high-technology companies in the US.

SMART objectives:

- To initiate and support Higher Education competitive team competition programs such as the Microgravity Research Program and to participate in programs such as RockOn that have been made available through other Consortia;
- To provide partial support to special projects of student organizations such as American Institute of Aeronautics and Astronautics (AIAA), SWE, NSBE, Astronomy Club, and Student Partnership for the Advancement of Cosmic Exploration (S.P.A.C.E.); and
- To support the development of at least two new STEM courses per year at undergraduate and graduate levels at WVSGC academic affiliates.

Research Infrastructure Programs

Goal: To contribute to NASA's and the state of WV's efforts at research infrastructure development (particularly in the high-technology sector).

SMART objectives:

- To support new faculty members at our academic affiliates through seed grants and assistance in building collaborative efforts with a NASA scientist. We will make at least 20 seed grant awards per year; and
- To help and support all faculty members at our academic affiliates to initiate collaborative research with the high-technology sector in WV. We will support at least two such projects per year.

Outcome 2

Goal: To support the development of innovative STEM related courses/activities and participation in professional development opportunities at the pre-college level.

SMART objectives:

- To support programs that enhance the use of NASA-developed training programs at the secondary education level for teachers in WV. Fund at least two such projects that would support STEM teachers to attend professional development opportunities (at least 10 teachers per year); and

- To support in-service and pre-service teachers to implement programs that would stimulate the interest of pre-college students in STEM areas. To support at least two teachers (or teams of teachers) to implement programs to cover a minimum of 50 students per year.

Outcome 3

Goal: To support the development of new and innovative extension and outreach programs such as conferences that promote the understanding, education, development, and utilization of space; seminars that encourage inter-disciplinary training and informal education activities for the general public in WV.

SMART objectives:

- To support and fund at least two projects in public extension and outreach per year; and
- To reach as many members of the public in WV as possible and enhance their understanding of the importance of STEM education, as well as the positive role NASA plays in high-technology workforce development. We aim to outreach to at least 1,000 members of the public in WV.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, and 3)

Outcome 1

Fellowship/Scholarship Programs

"Participation in the West Virginia Space Grant has allowed me to continue my education as a Biopharmaceutical Sciences Major at Shepherd University. This helped further my ability to pursue my goal to become a pharmacist. Participation in the WV Space Grant has also allowed me the opportunity to be a Chemistry Tutor for the Chemistry Department. Being a Chemistry Tutor has been a great experience where I not only get to help others learn and succeed, but also where I learn and succeed as well. By continuing my education and experience as a tutor, I have become a smarter and stronger individual and feel even more prepared for the experiences ahead of me in life. I am very grateful for the support received from the West Virginia Space Grant and the positive impact it has had on my education and my life. (Simone Brooks - on 12/28/14, 2013 West Virginia Space Grant Scholar, 2014 Affiliate Scholarship, City Pharmacy)

Higher Education Programs

The WVU Robotics Team comprises graduate and undergraduate students from a variety of disciplines. The team participated in competitive competitions that include the NASA Robotic Mining Competition, RASC-AL (RoboOps) Mars Rover competition, and the PISCES PRISM International Robotic Mining Competition.

- NASA Robotic Mining Competition held in Cocoa Beach, Florida. The team was awarded first place in the Mining Competition, first place in the Outreach Activity Award ; and first place overall and winner of Joe Kosmo Award. http://www.nasa.gov/2014 Robotics: Joe Kosmo Award
- WVU's robotics team, sponsored by WVSGC, won the top award among the eight teams selected to participate in the competition at the Johnson Space Center in Houston. http://wvutoday.wvu.edu/ .

- PRISM (PISCES Robotic International Space Mining competition) is an *international* robotic mining competition based on NASA's Lunabotics – a college-level engineering challenge for U.S. teams to design, build, and dig with a robot that can navigate, collect, and deposit regolith (soil). WVU won first place in the "best in mining" and "best in operations" competition. http://pacificspacecenter.com/

Research Infrastructure

Dr. John Christian, an awardee of a Research Initiation Grant (RIG) entitled: "Preliminary Development of the WVU Advanced Technology Satellite for Optical Navigation (WATSON) Student-Built Spacecraft" reported:

- Miranda Straub presented a paper entitled "Autonomous Optical Navigation for Earth-Observing Satellites Using Coastline Matching" at the AIAA Guidance, Navigation, and Control Conference (at the AIAA SciTech Forum) that was held in Orlando, FL.
- Began discussing outreach opportunities with a 7th grade science teacher at Suncrest Middle School. We hope to present a few short lessons to science classes about Newton's laws using space applications as examples

Outcome 2

WVSGC sponsored the annual WV FIRST LEGO® League state championship on the campus of Fairmont State University. Todd Ensign, NASA IV &V Educator Resource Center program manager, reported: "The number of teams in WV has grown from 68 last year to 102 teams this year necessitating Regional Qualifiers for the first time in our State's history." Overall participant interaction with 30 Elementary School Teachers; 60 Middle School Teachers; 5 HS teachers; 15 Pre-Service Teachers; 50 Informal Educators; 25 HE Faculty; ~500 Elementary School Students; ~1,000 Middle School Students; 48 High School students; 23 Undergraduates; 5 Graduates; 5 Administrators and over 1,500 parents/guardians and public at large. http://wvroboticsalliance.org/

Outcome3

Dr. Sytil Murphy, Shepherd University, winner of an Extension and Public Outreach Grant from WVSGC entitled: "Seeding Your Future Conference". The event targeted girls (grades 5-8, ages 11-14) and engaged their interests and abilities in STEM related fields and professions. The participants were guided through hands-on STEM related workshops under the guidance of STEM professionals. Overall direct participant interaction with 90 female students; 4 HE female Faculty: 2 female Industry Professionals; 3 female HS educators; and indirect with 54 volunteers primarily college students from the School of Natural Sciences and Mathematics. Dr. Murphy presented a contributed talk at the American Association of Physics Teachers 2014 Winter Meeting in San Diego, CA (Jan 3-7, 2015) entitled: "Re-envisioning the Panel Discussion" based on the data from the conference panel discussion.

PROGRAM ACCOMPLISHMENTS

A detailed description of WVSGC's accomplishments will be entered in OEPM. A brief description of accomplishments and projects supported in 2014 is provided below:

Outcome 1:

Fellowship, Scholarship, Internship

- WVSGC exceeded its goal of 120 as the minimum number of fellowships and scholarships. We made 145 affiliate level awards ($1,000 to $3,000 each) as well as 12 Undergraduate Fellowships (up to $5,000 each) and nine Graduate Fellowships ($24,000 each).
- WVSGC surpassed the original goal of 10 summer internships by supporting 15 such summer internships.

  According to our FY14 longitudinal tracking report, 62 students took the next step in FY14 (SG participation supported from FY06-FY14 funds): 10 are pursuing advanced degrees in STEM disciplines; 1 is seeking a STEM position; 3 accepted STEM positions at NASA contractors; 15 accepted STEM positions in industry; 1 accepted a position at NASA; 9 accepted STEM positions in academia and 23 went on to positions in non-STEM disciplines. The remaining students have not yet received the degree that they were pursuing when they received their Space Grant award.

Higher Education

- WVSGC met the targeted objectives for Higher Education.
    - Prepared students for STEM careers: Two WV undergraduate students, one from WVUIT and the other from WVWC, participated in the Aircraft Readiness Engineering Workshop hosted by NC and Connecticut SGC's.
    - Sponsored several special projects for students and student organizations. The programs include: AIAA; SWE; IIE; Rocketry Club, High School Visitation Day and support for NASA Scholars to attend conferences to present.
- Dr. Dimitris Vassiliadis was awarded a College Course Development grant for his project entitled "Distance-Learning Space Science Course."

Research Infrastructure programs

- We doubled our initial goal by sponsoring 44 faculty members, representing 10 Academic Institutions, and 18 Departments opportunities to perform research. Of the 41 Research Enhancement Awards, 39% were to female faculty members.
- Timothy E. Long, Ph.D. (Assistant Professor, Marshall University) and T. Ryan Withers, Ph.D. (Research Scientist at Progenesis Technologies, LLC) were awarded a Joint University-Industry Research Grant for initial work on the project entitled "Characterization of Biopolymer Production in *Pseudomonas aeruginosa*".

Outcome 2:

We met our goal and 15 teachers attended a professional development workshop provided by Dr. Libby Strong entitled "Science Promotes Literacy Workshop" with an indirect impact of 314 elementary students and 90 middle school students. Dr. Laurie Ruberg received a K-12 Professional and Curriculum Development award. She indicated that interactive K-12 student activities were conducted and the project: "Exploring the Environment-Global Climate Change" website continues to be available to students and

teachers. In this quarter, six blogs were published on the Capstone Web site: http://capstonegroupinc.wix.com/capstone-group-inc

Outcome 3:
Dr. Alice Hawthorne from Concord University for the project "Innovative Outreach Programs Inspire Interest in Science" indicated that they have implemented an outreach program in physics and astronomy that provides hands-on learning opportunities related to outer space and to inspire interest in sciences. Direct interaction reported by Dr. Hawthorne: 3 HE Faculty, 20 Elementary school students, 6 middle school students, 3 undergraduates, and 5 parents/guardians.
West Virginia Space Public Outreach Team (WV SPOT) is supported through a joint partnership between the National Radio Astronomy Observatory, NASA IV&V Facility and the WVSGC. It recruits and trains college presenters to bring presentations about current WV space science, technology, and engineering to WV K-12 classrooms, museums, and youth programs. This is the second year for the program, during the pilot year, over 1,660 K-12 students and 137 teachers in WV participated. As of the time of this report, WV participants impacted for this cycle: 29 K-12 Educators, 15 In Service Educators, 376 K-12 students, and 38 Undergraduate Student Ambassadors (representing five Universities). We have exceeded our outreach of at least 1,000 members of the public by continuing our efforts with WV SPOT and engaging in activities such as the Mon County 8th Grade Field Day, State Science Bowl Expo and the 62nd Annual WV State Science and Engineering Fair.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Diversity**: WVSGC sponsored students from each of the 12 Academic Affiliates representing diverse academic backgrounds. In FY 2014, students from 30 distinct academic majors participated in programs offered by WVSGC in the NIFs, Higher Education and Research Infrastructure areas. 40% of these students were female, and 10% were from under-represented groups.
- **Minority-Serving Institution Collaborations:** The only two MSIs in WV are members of the WVSGC. Bluefield State College (BSC)is represented by Dr. Guy Sims and WV State University is represented by Dr. Naveed Zaman on the Board of Directors of the NASA WVSGC. Both institutions were active in the Consortium and participated in a number of programs sponsored by WVSGC. Six NASA fellowships were awarded at WV State University and six were awarded at BSC. WVSGC continued its support of the Emerging Leaders Institute (ELI) at BSC. The goal of this program is to recruit and train minority college students in STEM fields to be mentored by a faculty member. These students visit area high schools and talk to minority students to encourage them to attend college and serve as a role model for them. ELI provides African-American students majoring in STEM fields at BSC with opportunities for leadership development through a comprehensive program based in leadership theory and practice.

- **NASA Education Priorities:**
  - Authentic, hands-on student experiences in science and engineering disciplines

Dr. Gerald Lang and Andrew Hoover, WVU, "Increasing student interest in STEM fields through Experimentation using the Science of Zip Lines." A one day activity that exposed minority students to the process of scientific experimentation using the science of zip lines.

- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Dr. Jackie Shia, Challenger Learning Center, provided professional development workshops to teachers in West Virginia through new program called eTechTeach. Provided pre-service and in-service teachers curriculum materials, as well as, introducing them to the "flipped learning concept". A "flipped classroom" which lesson material is presented through video, and class time is spent working on activities that promote higher order thinking skills.
- Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers. The 2014 Summer Aviation Camp, which was sponsored by WVSGC, provided exciting hands-on, aviation focused, experience to 42 pre-college students during a three day in-residence camp on the campus of WVU. The camp exposed students to the WVU Engineering campus gave them a chance to interact with current engineering students who served as mentors, allowed them to take part in activities at the Challenger Learning Center in Wheeling, WV, and gave them the opportunity to complete hands-on science projects with an aviation focus. Astronaut Jon McBride inspired the campers with his presentation on the last day of the camp.
- Community Colleges – NASA WVSGC has been awarded the NASA Space Grant Competitive Opportunity for Partnerships with Community Colleges and Technical Schools. The $500,000 award will go towards the WV Statewide Partnership to Advance Community College Education in STEM (WV SPACES). WV SPACES is a program that will offer opportunities to community and technical college students and faculty that will assist them as they seek meaningful educational opportunities and future jobs in STEM fields. The program offers students fellowships during the academic year for students to develop STEM-related projects in collaboration with faculty and/or other students.
- Environmental Science and Global Climate Change – Colin Komar received a Graduate Fellowship in 2013 and in 2014 for his project entitled: "Understanding the Transfer of Energy into near-Earth Space." He is currently a physics Ph.D. candidate at WVU graduating in May 2015. Komar has recently accepted a position to start May 2015 as a postdoctoral candidate at NASA GSFC (Goddard) in Greenbelt, MD working with Dr. Alex Glocer. His research will look for these effects in large-scale simulations of Earth's space environment and will be important for understanding space weather, the field of study that attempts to predict how solar activity will influence Earth's space environment. His position at Goddard is timely since there are two missions separately studying the radiation belts and magnetic reconnection. The Van Allen Probes mission is entering its third year studying the radiation belts, and NASA launched the Magnetospheric Multiscale mission in March 2015 to study magnetic reconnection throughout the

near-Earth space environment. Komar states, "I am especially grateful for the help and support of WVSGC throughout my graduate school career, which has helped me finally achieve my dream of becoming a NASA scientist."

IMPROVEMENTS MADE IN THE PAST YEAR

No new changes were made in the management or the matrix of programs offered by WVSGC in FY 2014.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

The Consortium is governed by a Board of Directors. In accordance with its Mission Statement and its by-laws, the Board sets all policies and procedures governing the Consortium operations. Characteristics of our academic and other affiliates of the Consortium are as follow:

- WVU, largest public university in the state, Land Grant, primarily research oriented, represented by Dr. Fred King.
- Marshall University, second largest public university in the state, research oriented, represented by Dr. Charles Somerville.
- Bluefield State College, an HBCU, primarily teaching oriented public university, represented by Dr. Guy Sims
- WV State University, an HBCU, Land Grant, primarily teaching oriented public university, represented by Dr. Naveed Zaman.
- Shepherd University, primarily teaching oriented public university, represented by Dr. Reza Mirdamadi.
- WV Wesleyan College, teaching and research oriented private college, represented by Dr. Joseph Wiest.
- Wheeling Jesuit University, teaching and research oriented private university, represented by Ms. Margie Cooke.
- Bethany College, teaching and research oriented private college, represented by Dr. Lisa Reilly.
- Fairmont State University, teaching and research oriented public university, represented by Dr. Donald Trisel.
- West Liberty University, primarily teaching oriented public university, represented by Dr. Robert Kreisberg.
- WVU Institute of Technology, research and teaching oriented public university, represented by Dr. Paul Steranka.
- Glenville State College, teaching and research oriented public college, represented by Dr. John Peek.
- The Clay Center for Arts and Sciences, non-profit organization with the mission to inspire creativity, learning and wonder through experiences in the arts & sciences, represented by Mr. Lewis Ferguson.
- WV High Technology Consortium Foundation, non-profit organization to promote high-technology and economic growth in the state, represented by Mr. James Estep.

- Polyhedron Learning Media, Inc., a technology development company specializing in creating educational software, audio/video, and print materials, represented by Dr. Jeanne Finstein.
- NASA IV & Facility, represented by Mr. Marcus Fisher, Associate Director.
- NRAO Green Bank Facility, home to the Robert C. Byrd Green Bank Telescope, the largest fully steerable dish in the world, represented by Dr. Karen O'Neil.
- Dr. Anne Cavalier, Educational Consultant.
- TMC Technologies, an Information Technology services company with significant contract experience at both Federal and State government levels, represented by Mr. L. Wade Linger Jr., President and Founder.